Non-linear mechanism of tsunami generation by bottom oscillations

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Abstract. The residual bottom displacements due to submarine earthquakes are the most effective tsunami generation mechanism, whereas fast bottom oscillations cannot generate the surface gravitational waves effectively. These facts are consequences of the linear fluid theory. Since strong bottom earthquakes certainly produce rather rapid bottom (water) motions, it is of great importance to estimate a nonlinear correction to the problem. For this purpose it is assumed that the fluid velocity values consist of a slow (time-averaged) component and an oscillating term. The oscillating term is calculated analytically in the framework of linear potential theory. Substitution of the fluid velocity into the Euler equations and averaging these equations in respect of time produces governing equations for the time-averaged flow. The non-linearity of the Euler equations gives new terms in the governing equations that can be considered as a mass force. Under certain conditions this force is capable of generating long gravitational waves of significant amplitude.

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